

Solutions Manual

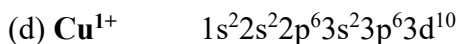
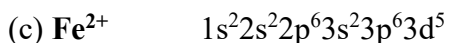
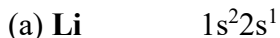
**Materials Engineering - Bonding, Structure, and Structure-Property Relationships
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Chapter 2

(2) Write the electron configurations for:



(3) What is the common oxidation state of calcium? Justify this on the basis of the filling of the electron orbitals.

The common oxidation of Ca is 2+. This can be justified by looking at its electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$. Calcium can reach a full electron shell [Ar] by losing its two 4s valence electrons and leaving it with an electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^6$.

(4) What would you expect the chemical formula of a compound of magnesium and sulfur to be?

Since the most common oxidation states are Mg^{2+} and S^{2-} , the chemical formula would be MgS

(5) Elemental analysis is performed on a sample of sodium silicate, and the Na:Si ratio is found to be 2:1. What is the chemical formula of the compound?

Taking the simplest case where there are 2 sodium ions and 1 silicon ion, this gives a total of 6 positive charges (2Na^+ and 1Si^{4+}). Silicates are oxide materials thus the anion will be O^{2-} . In order to maintain charge neutrality Na_2SiO_3 is the resulting compound.

(6) Suppose you have an ionic compound made up of silicon and fluorine. On the basis of your knowledge of common oxidation states, write the chemical formula of the compound.

The common oxidation states of silicon and fluorine are Si^{4+} and F^- respectively. In order to maintain charge neutrality, 4 fluorine ions are necessary for every silicon ion. A resulting chemical formula would be SiF_4 .

(7) What is the molecular weight of kaolinite ($\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$)? Show your work.

Al: 26.981539 g/mole

Si: 28.0855 g/mole

O: 15.9994 g/mole

H: 1.00794 g/mole

Molecular weight = $2(26.981539) + 2(28.0855) + 9(15.9994) + 4(1.00794) = 258.16\text{g/mole}$

(8) **What are the charges on each of the ions in apatite: $\text{Ca}_5(\text{PO}_4)_3\text{OH}$?**

Ca: 2+

P: 5+

O: 2-

H: 1+